

UNDERWATER

ASSOCIATION OF DIVING CONTRACTORS INTERNATIONAL

MAY/JUNE 2003

MAGAZINE

HANGING ON



**OFFSHORE OIL
IN THE AMERICAN
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The Marketplace: ROV Tooling

Without the right tooling package for a given subsea job, that shiny new \$3 million dollar work class ROV is just a really expensive underwater camera. We rounded up the leaders in ROV tooling from around the world to detail their latest offerings, with an introduction by **Steve Harbur** of Kraft TeleRobotics.

Remotely-operated vehicles (ROVs) come in all shapes and sizes. However, they all serve a single purpose – to provide a mobile platform that can transport the necessary tools to a subsea work site. All ROVs employ the same basic building blocks, namely a buoyancy package, thruster package, onboard hydraulic or electrical power unit, control and telemetry system, vehicle lighting, and a video camera. Although the size, shape, and complexity of ROV systems may vary greatly, with these basic building blocks in place, any ROV can travel to a submerged work site, maneuver within the water column, and deliver live video to a remote operator.

The difference between a low cost inspection ROV (often called a flying eyeball) and a large powerful work class vehicle lies in the ability of the larger vehicle to support manipulator arms, special tool packages, and other peripheral equipment that enables the vehicle to do more than just have a look around. However, without the integration of manipulator arms and special tooling, there is little difference between the work class vehicle and the low-cost inspection vehicle.

A complete work class ROV system may represent a capital investment exceeding \$3 million dollars, and over 90 percent of this can be attributed to the cost of the basic (ROV) vehicle, support equipment such as the tether management system, handling system, and operator control van. None of this expenditure, however, provides for manipulator arms or any tooling that would allow the vehicle to do real work.

If one thinks of the ROV as a method of delivering manipulator arms and tools to a work site, then skimping on the manipulator package makes little sense. To put things in perspective, the difference in cost of providing a customer with the best manipulator technology available, as opposed to offering him a low-end rate arm, could represent less

than three percent of your total investment.

Kraft Telerobotics manipulator arms provide force feedback, which improves operator awareness and greatly reduces the risk of doing damage to the work site or the manipulator arm itself. Its line of manipulator arms includes the Predator-7, and the innovative Mini-Master is a six-degree-of-freedom, miniature force feedback master controller designed for the confined operating environment in an ROV operator control van.

To accommodate operator preference, type of task, and a variety of mounting options, the Mini-Master's multi-position hand grip allows the ROV pilot to choose the most suitable configuration for any given situation. Fingertip controls on the hand grip provide the operator with direct access to core manipulator functions for fast, precise positioning of the manipulator arm. The arm allows the operator to control complex manipulator motions in a comfortable and intuitive manner.

The bottom line is that the manipulator arms on the front of a work class ROV may ultimately define the usefulness of the whole system, and the cost to provide a customer with the best manipulator technology available can be very small in comparison to the overall cost of fielding the complete system.

Sonsub

Sonsub has an extensive background in providing oil and gas operators, installation contractors, and service companies with day-to-day tooling aimed at reducing the time and high costs associated with off-shore operations. Torque tools, metrology tools, seal removal and replacement tools, and work skids are only a few of the many offerings in Sonsub's extensive line of tools. Based on future planned deepwater activities and the idea that ROVs will advance into high horsepower, ultra-deepwater, construction-based systems, Sonsub has been working with several major Gulf of Mexico operators to manufacture pipeline repair tooling packages.



Sonsub's FBE and Weld Seam Removal Tool.

Sonsub's "value added" systems are the first packages of the current tooling evolution. Some components of these advanced pipeline repair tooling packages are the company's Diamond Wire Cutting Module, End Preparation and Deburring Tool, FBE and Weld Seam Removal Tool, and the similar Concrete and FBE Removal Tool.

The Diamond Wire Cutting Module (DWCM) was designed to perform deepwater cutting operations. A heavy work-class ROV mechanically and hydraulically mates with the tool, providing power, control, and means of maneuvering the unit underwater. The system then attaches to the damaged pipe by a set of hydraulic clamp arms. The cutting element is a special diamond-coated wire, formed into a closed loop. This is kept under tension and rotated at high speed by pulleys arranged on a pivoting frame, which traverses an arc driving the wire through the pipe as it cuts.

A key feature of the tool is its ability to cut pipelines under any com-

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